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VII SE	EMEST	A Constituent Institution	n of Manipal University 1. (BME) D	EGREE ENI	D SE	M. F	EXAN	MIN	ATIO	ONS	, NO	• V / D	ЭЕC,	2016.	
	SUBJECT: OPERATIONS RESEARCH (BME 433)														

(REVISED CREDIT SYSTEM)

Wednesday, 23rd November 2016: 2 to 5 PM.

TIME: 3 HOURS

MAX. MARKS: 100

Instructions to Candidates:

- 1. Answer any FIVE full questions.
- 2. Missing data may be suitably assumed.
 - 1A. Give an account of information to set up L.P. model of Product Mix problems. 06
 - 1B. A company has contracted to supply 3000 units of product A and 3500 units of product B to its customer. Each product must be processed on both Machine 1 and Machine 2 in company's machine centre.. The table below gives processing time for each product and maximum machine hours available.

	Processing	hours /unit for	Max.hours			
	Product A	Product B	available			
Machine 1	0.05	0.04	200			
Machine 2	0.02	0.06	150			

To meet the customer demand, the company intends to buy some units of both A and B from one of its vendors. The vendor charges Rs 280/unit for product A and Rs 250 for product B, whereas Company's in-house production cost per unit is Rs.200 for A and Rs.180 for B. Formulate the LP Problem .incorporating above data. Do not solve. But draw the first simplex tableau, Identify the key number...

- 2A. Explain slack, surplus and artificial variables and their physical meaning. 06
- **2B.** Given below a L.P. Problem for producing 4 products using 2 resources: Maximize $Z = 2X_1 + 8X_2 + 10X_3 + 6X_4$ (Total Profit) Subject to $2X_1 + 1X_2 + 4X_3 + 2X_4 \le 200$ (Material available) $1X_1 + 2X_2 + 2X_3 + 1X_4 \le 160$ (Machine hours available) $X_1, X_2, X_3, X_4 \ge 0$

problem is sh	nown be	low :-	_						
Linit Drofit	Pooio	0	Cj	2	8 Va	10 Xa	6 V.	0	0
	Dasis	Q 		▲1 	^ 2	^ 3	^ 4	J1	3 2
6	X_4	80		1	0	2	1	2/3	-1/3
8	X2	40		0	1	0	0	-1/3	2/3

The optimal simplex tableau (without Zj and Cj - Zj row) for the above

a) Complete the Zj and Cj -Zj row. What is the total profit and unit worth of each resource?

b) Conduct sensitivity analysis w.r.t. R.H.S. values.

c) Conduct sensitivity analysis w.r.t. profit coefficients.

d) Suppose that the profit coefficient of X1 increases to 6, will it give rise to an alternate optimum? If yes, find the alternate solution.

3A. A company has received order for four jobs. It wishes to assign three jobs to 06 its 3 workers and one of the jobs to a subcontractor. The cost of assigning the jobs is shown below.

	Job	1	2	3	4
Operator	A	50	50		40
	В	70	60	80	50
	С	55	45	75	50
Subcontrac	tor	60	40	50	45

The operator A cannot do the job 3. Determine optimal assignment using Assignment Algorithm and the job to be subcontracted.

3B. A company is shipping its products from its 3 plants to 3 warehouses A, B and C every quarter. The capacity of the plants, the requirements of warehouses and unit shipping cost are shown below

Ware house	A B		С	Capacity (000's			
Plant 1 2 3	3 8 5	5 7 8	5 8 6	21 14 29			
Requirements (000's)	8	20	20				

The present distribution policy of the company is:

Plant 1 supplies 8,000 units to Warehouse A and 6,000 units to warehouse B. Plant 2 supplies 14,000 units to Warehouse B .and Plant 3 ships 20,000 units

to Warehouse C.

(a) Check whether the present transportation schedule is optimal. If not, find the optimal schedule using Transportation Algorithm. (b) Find the alternate optimum if any. (c) If the company wants to close one of the plants, which should it be?

- 4A. In an assembly line operation, parts arrive at a machine at a mean rate of 8 per hour. The operator processes 10 parts per hour. Determine (i) Number of parts waiting to be worked on. (ii) Number of parts in the system. (iii) Percentage of the time the operator is busy. (iv) Probability that machine is idle. (v)) The management desires to have their operators working 90% of the time. Determine the time between the arrival that will allow the operator to meet this criterion.
- **4B.** Given below are the probability distributions of inter-arrival time (IAT) and **15** service time (ST) at the registration counter of a hospital :

IAT (minutes) :	1	2	3	4	5
Probability :	0.10	0.22	0.30	0.25	0.13
ST (minutes) :	2.	3	4	5	
Probability :	0.15	0.20	.0.35	0.30	

. Simulate 10 arrivals using the following random numbers: Random No. for IAT 84, 46, 77, 61, 08, 39, 74, 00, 99, 24 Random No. for ST: 72, 48, 03, 26, 31, 78, 92, 34, 91, 43

From the simulation experiment determine a) Expected busy time of the clerk.

(b) Expected time spent by the patient in the queue. (c) Expected time spent by the patient in the system. (d) Are the results obtained reliable? Justify your answer.

5A. Explain the following w.r.t. Game Theory Models: (i) Payoff Matrix (ii) Pure and Mixed Strategy Game (iii) Value of the Game.

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5B. Identify the optimal strategies and value of the game for the Game given **03** below:

	B1	B2	B3	B4
A1	8	6	2	8
42	8	9	4	5
43	7	5	3	5

Explain the criteria you have used in solving the Game

5C A company plans to introduce 3 new products A, B and C. The maximum **14** sales promotion (SP) budget is \$.45000. The relationship between the various SP levels and expected contribution as shown below:

		А			В				С	
SP(\$ 000's)	10	15	20	10	20	30	10	15	20	25
Contribution (\$ 0000's)	15	25	30	15	25	35	20	25	28	30

Use 3 stage Dynamic Programming technique to determine SP expenditure on each product.in order to maximize total contribution. Each product must receive some expenditure. The above packages are neither divisible nor repeatable.

- **6A.** Write short note on PERT and three time estimates.
- **6B** The assembly and installation of a Radio Therapy Equipment involves **14** completion of 9 jobs. The job labels, time required and immediate predecessors are given below.

Job Time (days)	A 5	В 7	C 9	D 8	E 10	F 4	G 6	H 5	 7
Predecessors		Â	Ă	С, В	C	D	Ċ	E, F	Ĥ

(i) Draw the network. And find the shortest possible completion time.

(ii) Prepare a table of four activity times, total, free, and independent floats for each activity. (iii) Outline the ways to reduce the project time.

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